



Oral microbiome research – working in partnership with Indigenous Australian communities

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Microbiome research is currently biased towards populations of European descent, with such populations providing a weak basis upon which to understand microbiome-health relationships in under-studied populations, many of whom carry the highest burdens of disease. Most oral microbiome studies to date have been undertaken in industrialized countries. Research involving marginalised populations should be shaped by a number of guiding principles. In the Indigenous Australian context, one useful framework is the Consolidated Criteria for Strengthening Reporting of Health Research involving Indigenous Peoples (CONSIDER) statement. This paper describes how the microbiome research field is having impacts in the Indigenous Australian health space, and describes a particular project involving Indigenous Australians in which the CONSIDER statement is used as the underlying framework.

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Research involving marginalised populations should be shaped by a number of guiding principles. In the Indigenous Australian context, such principles should include that Indigenous communities are engaged in all aspects of the research process, and that such research processes account for the diversity, priorities and shared values of Indigenous peoples and their communities. One useful framework to utilise in this context is the Consolidated Criteria for Strengthening Reporting of Health Research involving Indigenous Peoples (CONSIDER) statement (Huria *et al.*, 2019). This paper describes how the microbiome research field is having impacts in the Indigenous Australian health space, and describes a particular project involving Indigenous Australians in which the CONSIDER statement is used as the underlying framework.

Microbiome research is a rapidly developing field that will likely yield many population health benefits. However, any form of genetic research that involves socially disadvantaged groups raises sensitive issues. Genetic research involving Indigenous groups is especially fraught. Indigenous groups at a global level have raised concerns about lack of engagement in research involving genetics, including the results having negligible benefits to communities, insufficient ethical oversight, exploitation of biological samples, and victim-blaming approaches that reinforce racism in health care settings (Kowal *et al.*, 2012). Contemporary microbiome research is biased towards populations of European descent (Rogers *et al.*, 2021). Such populations, by definition, provide a poor basis from which to understand microbiome-health relationships in under-studied populations, including groups who carry the highest burdens of disease.

A similar inequity persists in oral microbiome research, with most oral microbiome studies to date being undertaken in industrialized countries such as the United States and China. Although the US in particular has invested heavily in microbiome research (including \$US48M for oral microbiome research between 2012–2016) (Procter *et al.*, 2019), few studies have included people from non-European backgrounds, including people of Asian or Indigenous heritage, or African Americans. If studies do not reflect the diversity of populations in a given society, oral health inequities will increase, with those most likely to benefit from improvements in oral health therapies based on microbiome research being less likely to do so (Jamieson, 2021). Given that oral health is socially patterned, oral microbiome research should be over-represented in socially vulnerable groups. Increased social and racial diversity in oral microbiome research would also benefit well-represented groups. This is especially the case for Indigenous groups, given that transitions from hunter-gatherer to industrialized lifestyles have been linked to oral health deterioration (Arantes *et al.*, 2018), meaning increased understanding of the pathways through which oral microbiomes shift could yield crucial insights into how oral health could be improved in contemporary societies.

There are many barriers contributing to minority group under-representation in oral microbiome research. From the Indigenous Australian perspective, these include cultural safety obstacles, as research staff may be inadequately trained to design and implement studies in partnership with Indigenous groups. Studies may take longer to complete, especially if travel is required to regional

and remote locations in order to source a representative sample. The resources to recruit and retain a sufficient number of participants across different backgrounds may be limited, as well as the resources required to recruit, train and retain staff with the appropriate cultural sensitivities (Meharg *et al.*, 2023). Indigenous communities are frequently reluctant to participate in biomedical research due to past experiences of exploitation, experiences of racism and feelings of distrust towards field researchers and academics (Bainbridge *et al.*, 2015). The goal of increasing equity, inclusion and diversity in oral microbiome research can thus only be pursued in full partnership with the minority groups involved. This includes in all aspects of the research process, including research design, grant funding application, ethics applications, staff recruitment and training, community consultation, data collection, data analysis and dissemination of research findings back to community and to the public more broadly. Crucial in the field of genomics is creating culturally sensitive resources describing how, and for how long, samples and data will be collected and stored (Soares *et al.*, 2023).

Following an 18-year partnership with the Indigenous South Australian community, we are now involved in a study investigating changes in the Indigenous oral microbiome and impact on markers of chronic disease following culturally safe dental care (Jamieson *et al.*, 2023). Recruitment strategies are based on those successfully implemented in our past Indigenous dental projects, with participants primarily sourced from participating Aboriginal Community Controlled Health Organisations (ACCHOs). The focus on reciprocal and respectful engagement plays a large role in where and how data collection takes place, and how findings will be disseminated (Poirier *et al.*, 2022).

The CONSIDER statement was the framework used for Indigenous community engagement and partnership (Huria *et al.*, 2019). Based on a meta-synthesis of guidelines about the conduct of health research in partnership with Indigenous peoples from Australia, Canada, the United States, New Zealand, Taiwan and Scandinavia, the CONSIDER framework comprises eight criteria. These include governance, relationships, prioritization, methodologies, participation, capacity, analysis and findings, and dissemination. Implementing this approach is especially important when undertaking research of a sensitive nature with Indigenous groups, including genomics. Table 1 provides an outline of the engagement, consultation and recruitment strategies used in the Indigenous oral microbiome study documented against the CONSIDER statement's research reporting framework.

In their systematic review of strategies for improving health research outcomes among socially vulnerable populations, Bonevski and colleagues (2014) recommended that researchers allow for extended timeframes, have flexible protocols for recruitment and follow-up, and contingency plans for higher-than-anticipated financial costs. The limitations of current health research funding bodies, including those for oral microbiome research, however, precludes much of this. For example, there are usually tight fiscal parameters, rigid timeframes, and no factoring in of crucial community engagement processes.

By embracing the CONSIDER framework, we have demonstrated the importance of culturally-safe community consultation processes to facilitate an Indigenous oral microbiome project that includes provision of dental care and which allows for longer time frames than what is normally permitted in the current competitive grant funding climate. Our findings will likely yield important

Table 1. Use of the CONSIDER statement as a framework for an Indigenous Australian oral microbiome project

1. Governance	Formal letters of support from ACCHOs, harm minimisation emphasised throughout informed consent processes and ethics requirements (facilitated by open and transparent communication processes), protection of Indigenous intellectual property and knowledge through informed consent process
2. Relationships	Relationship formed with Indigenous dentist for provision of culturally-safe care, relationships also formed with local public dental service provider for eligible participants, Indigenous staff employed for recruitment and data collection, all non-Indigenous staff undertaking cultural competency training.
3. Prioritisation	Indigenous CEO from an ACCHO provided original idea for the study, with extensive community engagement and consultation undertaken to refine the study aims.
4. Methodologies	Baseline questionnaire (as a consequence of community consultation) included items pertaining to social and emotional wellbeing and access to health services, collection of oral microbiome data (plaque, saliva, calculus) taking minimal amount of time and minimal impost on participants, point-of-care testing used to minimise volume required for blood/urine collection.
5. Participation	Consent forms explicitly stating that no third parties will have access to samples or data; participants made aware, during the informed consent process, of the time commitments to being involved in the study; all oral microbiome samples deidentified, data stored on password-protected computer software
6. Capacity	Study participants able to increase their knowledge of the oral microbiome and its impacts on dental and general health through regular dialogue with the research team; two-way knowledge-sharing, with substantial benefits for the non-Indigenous research staff in being included in Indigenous consultative processes and learning from ACCHOs and study participants.
7. Analysis and findings	Key Indigenous stakeholders and researchers will be included as co-authors in publications. This will enable Indigenous values and perspectives to continue to contribute to study finding interpretations
8. Dissemination	Will include presentations to Indigenous stakeholder and other community groups, presentations at international conferences by Indigenous project staff, newsletters and blogs to community groups, scientific articles co-authored by Indigenous researchers and stakeholders

information on how the oral microbiome mediates general and dental disease risk within an Indigenous population. But more importantly, it addresses an Indigenous community priority and is conducted in a way that is respectful to Indigenous participants and transparent about how data will be collected, stored and used. The findings will hopefully provide evidence of the important role ACCHOs play in linking the oral health–general health praxis to increase understanding at the broader community level of how improved oral health contributes to overall improved general health, through the oral microbiome. The project is an exemplar of how carefully calibrated, data-driven disease models can integrate with Indigenous community views and expectations to estimate disease burden, deliver culturally safe dental care and guide policy decisions for more equitable resource distribution that includes dental, and specifically the oral microbiome, as part of chronic disease management for Indigenous Australians. It is important that any oral microbiome partnerships with marginalised communities are fully cognisant of the sensitivities that need to be acknowledged and addressed.

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